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3,826,665 SETTING AND HARDENING OF ALUMINOUS CEMENT

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8 Claims

ABSTRACT OF THE DISCLOSURE

The inclusion of a composition comprised of (1) lithia or a water-soluble lithium salt and (2) a hydroxylated organic acid, or a salt or ester thereof, accelerates the setting and hardening times of aluminous cement and provides mortars, concretes, grouts, etc., derived from such modified high alumina type cements wherein the superior mechanical and handling properties generally characteristic of aluminous cements are not appreciably affected.

BACKGROUND OF THE INVENTION

The present invention relates to a new composition which, when incorporated into aluminous cement, accelerates the setting and hardening of same and to improved mortars and concretes derived from aluminous cement modified with the aforementioned adjuvant composition.

Aluminous cement has as its major constituent mono-calcium aluminate and is typically a slow setting cement. In spite of its slow setting time, aluminous cement is widely used in the building and construction industries inasmuch as mortars and concretes containing this cement as a binder possess the requisite fluidity during mixing. Moreover, once hardened, the final products evidence a high level of mechanical performance over extended periods of time. Also, aluminous cement is resistant to bases and attains its maximum strength more rapidly than Portland cement and, unlike Portland cement, is capable of withstanding solutions of sulfates.

In order to maximize the advantageous characteristics of an aluminous cement, as described above, and to make it available for those applications where it is necessary to use cements which rapidly set and harden, it is often necessary to reduce the time required for setting and hardening of the aluminous cement by adding an adjuvant thereto.

A number of compounds have heretofore been proposed as additives to accelerate setting and hardening of cements. For example, German Pat. No. 648,851 and French Pat. No. 1,574,213 disclose lithia or water-soluble lithium salts for this purpose; however, mortars and concretes which are modified in accordance with these prior patents by adding the indicated lithium compounds become rigid almost immediately upon mixing and, hence, lack sufficient fluidity for most practical applications of the resultant compositions. Moreover, such prior art compositions evidence a tendency to crack in a relatively short time.

Thus, a need exists for a composition and a process for improving the setting and hardening of aluminous-type cements without adversely affecting the handling characteristics and the mechanical performance of mortars, concretes and analogous products derived from such cements.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of this invention to provide for incorporation into cements having a high content of mono-calcium aluminate an adjuvant which avoids the disadvantages of prior art additive agents for such

cements as well as for concretes, mortars and the like derived from same.

Another object of the present invention is to provide a process for improving the setting and hardening of aluminous cements comprising adding a two-component adjuvant composition to the cement to yield cement-containing products having accelerated setting and hardening characteristics while at the same time retaining desired fluidity and other similar handling properties as well as acceptable mechanical performance.

Other objects, features and advantages of this invention will become more apparent to those skilled in the art from the detailed description of the invention which follows.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the present invention, it has been found that a composition resulting from the association of lithia or water-soluble lithium salts with a hydroxylated organic acid or a salt or ester thereof, in weight ratios with regard to the cement of from about 0.005 to 1% for lithia or water-soluble lithium salts with a hydroxylated the hydroxy acid, preferably between about 0.01 and 0.05% for each of the two components, is an extremely valuable adjuvant composition for improving the setting and hardening of aluminous cement and mortars and concretes prepared from such a cement. Thus, the ratio of the two components is between 1000:1 and 1:200 and in the preferred embodiment, the adjuvant is a combination of the lithium compound and hydroxy acid compound in the ratio of from 1:5 to 5:1. In practicing the present invention, the binary composition comprised of lithia or a lithium salt together with a hydroxylated organic acid or a derivative thereof, can be incorporated directly into the aluminous cement or into mortars and concretes during their manufacture or, alternatively, may be added to the mixing water.

In general, practically any water-soluble mineral or organic salt of lithium is suitable for use as the first component of the binary adjuvant compositions of the present invention. Exemplary of common lithium salts which may be utilized in this context are lithium chloride, lithium bromide, lithium iodide, lithium sulfate, lithium nitrate, lithium dichromate, lithium perchlorate, lithium formate, lithium acetate, lithium benzoate, lithium oxylate, etc.

The preferred hydroxylated organic acids suitable for use as the second component of the adjuvant composition include tartaric, citric, gluconate, malic, lactic and salicylic acids. Moreover, salts of the foregoing, preferably alkali metal salts, and esters thereof in which the acidic or alcoholic functions are partially or wholly esterified may be used. Preferably, the acid and alcohol groups are esterified through lower alkyl compounds and lower fatty acids respectively.

In order to further illustrate the present invention and the advantages thereof, the following specific examples are given, it being understood that same are intended merely as illustrative and in no wise limitative.

Example 1

In this example, a mortar composition was prepared according to the French standard NF.P 15.403 ("Catalogue des normes francais") utilizing the following components:

	Grams
Normal sand (French standard NF.P 15.403)	1350
Aluminous cement	450

The mortar was prepared according to the method described in the foregoing French standard with the exception that the ratio by weight of water to cement was decreased from 0.5 set forth in the standard to 0.45 inasmuch as it was found that the quantity of water must